

Claims

1. (previously presented) A spin valve comprising:
 - a) an antiferromagnetic layer,
 - b) a ferromagnetic pinned layer having a magnetization pinned by the antiferromagnetic layer,
 - c) a ferromagnetic free layer,
 - d) a nonmagnetic spacer layer located between the free layer and the pinned layer such that the pinned layer controls a magnetization of the free layer, and
 - e) a first underlayer in proximity to the free layer and having a thickness between about 2 nm and about 40 nm;wherein the first underlayer comprises an oxygen-rich nickel oxide.
2. (original) The spin valve of claim 1, wherein the first underlayer has a first oxygen content sufficient to raise a magnetoresistive ratio ($\Delta R/R$) of the spin valve to between about 7% and about 9%.
3. (original) The spin valve of claim 1 wherein the content of oxygen in the first underlayer is between about 55 atomic% and about 65 atomic%.
4. (canceled)
5. (original) The spin valve of claim 1, further comprising a second nickel oxide underlayer adjacent to the first underlayer,
6. (original) The spin valve of claim 5, wherein the second nickel oxide underlayer is an oxygen-rich nickel oxide underlayer.

7. (original) The spin valve of claim 6, wherein the content of oxygen in the first underlayer is different from the content of oxygen in the second nickel oxide underlayer.
8. (original) The spin valve of claim 7, wherein the content of oxygen in the second nickel oxide underlayer is between about 50 atomic% and about 60 atomic%.
9. (previously presented) The spin valve of claim 6, wherein the combined thickness of the first underlayer and the second nickel oxide underlayer is between about 2 nm and about 40 nm.
10. (previously presented) The spin valve of claim 6, wherein the first underlayer has a first oxygen content and the second nickel oxide underlayer has a second oxygen content sufficient to raise a magnetoresistive ratio ($\Delta R/R$) of the spin valve to between about 7% and about 9%.
11. (previously presented) The spin valve of claim 6, wherein the first underlayer has a first oxygen content and the second nickel oxide underlayer has a second oxygen content sufficient to balance the magnetoresistive ratio $\Delta R/R$ and a pinning strength H_{0a} .
12. (original) The spin valve of claim 11, wherein the $\Delta R/R$ ratio is between about 7% and about 9%, and the value of H_{0a} is between about 800 Oe and about 400 Oe correspondingly.
- 13 - 21. (canceled)

22. (previously presented) A disk drive system comprising a read/write head containing a spin valve, wherein the spin valve includes:
- a) an antiferromagnetic layer;
 - b) a ferromagnetic pinned layer having a magnetization pinned by the antiferromagnetic layer;
 - c) a ferromagnetic free layer;
 - d) a nonmagnetic spacer layer located between the free layer and the pinned layer such that the pinned layer controls a magnetization of the free layer; and
 - e) a first underlayer in proximity to the free layer and having a thickness between about 2 nm and about 40 nm;
- wherein the first underlayer comprises an oxygen-rich nickel oxide.
23. (original) The disk drive system of claim 22, wherein the first underlayer has a first oxygen content sufficient to raise a magnetoresistive ratio ($\Delta R/R$) of the spin valve to between about 7% and about 9%.
24. (original) The disk drive system of claim 22, wherein the content of oxygen in the first underlayer is between about 55 atomic% and about 65 atomic%.
25. (canceled)
26. (original) The disk drive system of claim 22, wherein the spin valve further comprises a second nickel oxide underlayer adjacent to the first underlayer.
27. (original) The disk drive system of claim 26, wherein the second nickel oxide underlayer is an oxygen-rich nickel oxide underlayer.
28. (original) The disk drive system of claim 27, wherein the content of oxygen in the first underlayer is different from the content of oxygen in the second nickel oxide underlayer.

29. (original) The disk drive system of claim 28, wherein the content of oxygen in the second nickel oxide underlayer is between about 50 atomic% and about 60 atomic%.
30. (previously presented) The disk drive system of claim 27, wherein the combined thickness of the first underlayer and the second nickel oxide underlayer is between about 2 nm and about 40 nm.
31. (previously presented) The disk drive system of claim 27, wherein the first underlayer has a first oxygen content and the second nickel oxide underlayer has a second oxygen content sufficient to raise a magnetoresistive ratio ($\Delta R/R$) of the spin valve to between about 7% and about 9%.
32. (previously presented) The disk drive system of claim 27, wherein the first underlayer has a first oxygen content and the second nickel oxide underlayer has a second oxygen content sufficient to balance the $\Delta R/R$ ratio and a pinning strength H_{ua} .
33. (original) The disk drive system of claim 32, wherein the $\Delta R/R$ ratio is between about 7% and about 9%, and the value of H_{ua} is between about 800 Oe and about 400 Oe correspondingly.
34. (canceled)